ADVANTAGES OF USING SOLIDWORKS SOFTWARE FOR SOLVING STATIC PROBLEMS IN STRENGTH OF MATERIALS SCIENCE

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ABSTRACT: This article shows the advantage of using modern innovative technologies in the teaching of the science of resistance of materials, which is one of the technical sciences, and using the SOLIDWORKS program to increase students' interest in the science, increase students' visual imagination, reduce the burden of calculation book processes on students, and obtain concepts about the accuracy of the results are given.

KEY WORDS: Hammer, epura, sterjen, elongation and compression, cutting method, computer program

The course on resistance of materials teaches the methods of determining the stresses and deformations created in the structural elements of machine parts and structures, as well as the methods of calculating the strength, uniqueness and superiority of these structures. The purpose of the course is to provide students with basic skills in design and construction calculations, which are considered one of the main issues in the process of designing structures. Students should master the basic formulas in order to correctly choose the computational models of building constructions, to use the calculation formulas of the course and modern calculation methods in solving practical problems.

The following two different methods were used to solve problems related to the topic "Static exact problems in stretching and yielding" from the practical lesson of the science of resistance of materials.

Method 1. Solving problems using a notebook, pen, ruler, pencil and calculator.

Method 2. An experimental lesson was conducted using a computer and the computer program "SolidWorks" in solving problemsIn the experimental lesson, we will give an example of the methods mentioned above. Let us have the following example:

A three-stage steel boom of known length and diameter is loaded with longitudinal forces F1=30kN, F2=65kN, F3=170kN as shown in the drawing, and the specific weight of the boom is e' neglected, construct the longitudinal force and stress diagrams. In this case, d=2cm; l1=20cm; l2=30cm; l3=20cm.

Method 1. Starting from the right side, we divide the stern into three sections. Using the cutting method, we first determine the longitudinal force N for each section.

Interval I: we construct the balance equation of the stern piece shown in Fig. 1 (b):

$$\sum Z_i = F_1 - N_1 = 0$$

in this

$$N_1 = F_1 \text{ or } N_1 = 30kN$$

(1.5) according to the expression, normal stress

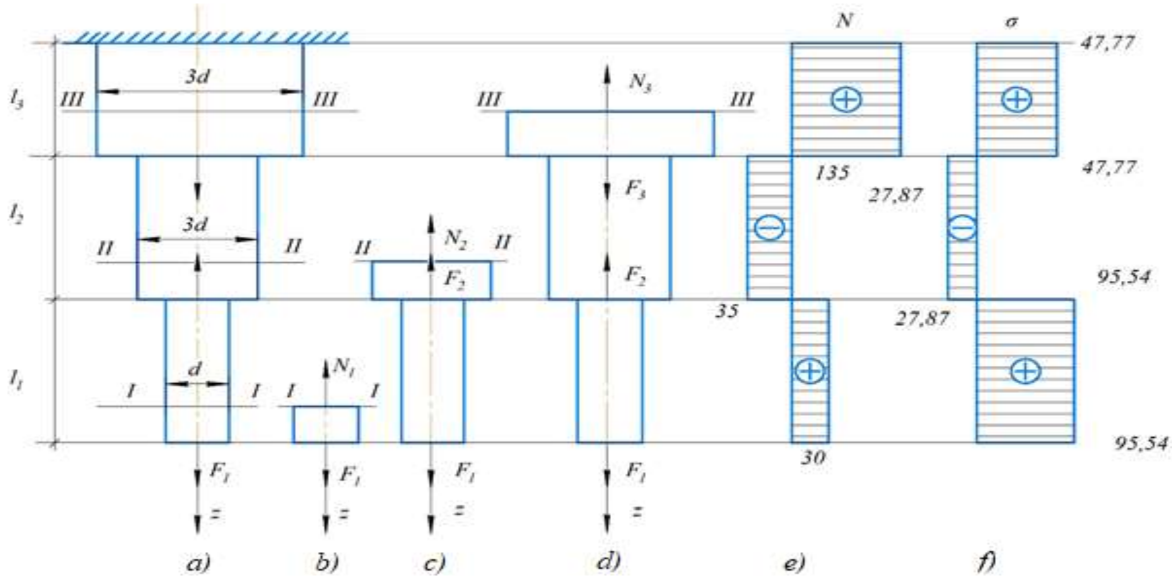
$$\sigma_1 = \frac{N_1}{A_1}$$

is equal to , where

$$A_1 = \frac{\pi d^2}{4} \cong 3{,}14 \cdot 10^{-4} m^2$$

So,

$$\sigma_1 = \frac{30 \cdot 10^3}{3{,}14 \cdot 10^{-4}} = 95{,}54 \cdot 10^6 \frac{N}{m^2} = 95{,}54\, MPa$$



Pic 1. Sterjen detailed tensile and compressive testing, and longitudinal force and tension plot

Interval II: For the slice depicted in pic. 1(c):

$$\sum Z_i = F_1 - F_2 - N_2 = 0.$$

From this,

$$N_2 = F_1 - F_2 = -35 kN$$

$$\sigma_2 = \frac{N_2}{A_2} = \frac{-35 \cdot 10^3}{\frac{\pi (2d)^2}{4} \cdot 10^{-4}} = -27{,}87\, MPa$$

Interval III: Using the plot of Pic. 1 (d), we calculate the following:

$$\sum Z_i = F_1 - F_2 + F_3 - N_2 = 0.$$

From this,

$$N_3 = F_1 - F_2 + F_3 = 135\, kN$$

$$\sigma_3 = \frac{N_3}{A_3} = \frac{135 \cdot 10^3}{\frac{\pi (3d)^2}{4} \cdot 10^{-4}} = 47{,}87\, MPa$$

So, as we said above, we can see the states of strength and tension from the diagram shown in Pic. I. (f).

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